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ABSTRACT

This study sought to determine if participation as a musician or an athlete had an effect on academic achievement as measured by standardized test scores. It was hypothesized that students who received training as musicians would score higher on the core battery composite of reading, language, and mathematics sections of the California Achievement Test than their athletic and non-musician peers, and that the amount of time spent (years of music study or athletic participation) would have a significant effect on test scores. Subjects were 346 students who performed in the band or the choir, were athletes, or were nonparticipants in either music or athletics. Data were collected from 1991 through 1995 (grades 5 through 9). Results show that although the mean scores for musicians were higher than nonmusicians/nonathletes, participation in music was not a conclusive factor in predicting statistically higher academic scores than those of nonmusicians and nonathletes. Musicians did score higher than the athletes did, and over time this gap widened. Findings indicate that factors other than enrollment in a performing music class were affecting the outcome. The schools represented in this study reflected a cross section of different types of music programs. Results also indicated an overall drop in standardized test scores in the ninth grade that was not seen for student musicians. Two appendixes contain data tables for the study. (Contains 9 tables and 41 references.) (SLD)

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The Impact of Music Education and Athletic Participation on Academic Achievement

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INTRODUCTION

For many years, music educators have dealt with this question: Did their students achieve at a higher academic level than their nonmusician peers because they were more intelligent or could some portion of this higher achievement be attributed to their training as musicians? Music educators have long believed that music, as a discipline, was drawing the best and brightest, but the effect that music has on students' academic ability has just begun to come to light.

Prior studies (Friedman, 1993; Lillemyr, 1993) indicate that music instruction has a positive effect on academic achievement. Higher reading and math scores were found for those students who were trained as musicians and, additionally, it has been determined that the amount of time one spends in music instruction further enhances academic achievement (Trent, 1997).

Another study has shown that the link between music and academic achievement is still inconclusive. A correlational study found no significant positive correlation between standardized math and reading scores and kindergarden-third graders' music proficiency (Barrett, 1994). Additionally, there is evidence to both support and refute the position that students who participate in any after-school activities such as athletics or school sponsored organizations do better academically because of their increased interest and the self discipline they learn (Melnick,1992; Trent,1997). Self discipline certainly plays a role in student academic acheivement, but musicians tend to show even higher levels of acheievement than others.

The attitude of much of the general public and of many school districts is that music education is an academic *frill*, taking up precious time that might be better spent in

other academic disciplines. Although research is beginnig to show a correlation between music education and academic achievement, some of the *lay literature* has refuted research showing this correlation. Viadero (1998) stated,

> but can music really make children smarter? Researchers can't say for sure. Compared with some other educational interventions, the studies on music are a thin lot....Little is known, for example, about what kinds of musical training produce results and what kinds don't, who benefits the most, and how long any intellectual gains that result from music learning will last. (p.17)

The larger question for all educators is: Does musical training have an effect on academic ability and, if so, how proportional is this effect over a long period of time? If it is found that musical training has a significant effect on academic ability, the implications for music education as a curricular subject would be enormous. Music education might well begin to take its place alongside mathematics, language arts, and the social sciences in the *core* curriculum, subject to the same importance given to these other courses.

This study was conducted to determine if there was any significant effect of music training on academic ability, this study examined what effect music class enrollment had on the reading, language, and mathematics portions of the California Achievement Test (CAT) over an extended period of time.

This study hypothesized that students who received training as musicians would score higher on the core battery composite of reading, language and mathematics sections of the California Achievement Test than their athletic and nonmusician peers and that the amount of time spent (years of music study or athletic participation) would have a significant effect on test scores.

Significance of the Problem

This study sought to add to the growing body of literature that suggests that training as a musician has a positive impact on a student's academic ability. The instruments used to measure the effects (CAT tests) are commonly used across the United States by thousands of school districts to measure the academic abilities of their students. As such, the scores produced by the CAT have accepted reliability and validity. The results of this study may reveal common links between academic success and music education and give an impetus to expanding music education as a means to further improve academic achievement.

For the purpose of this study, the following definitions were specified:

Academic achievement - test scores on selected sections of the California Achievement Test (CAT).

Musician- any student enrolled in the school music program from 5^{th}–12^{th} grades and who was not a member of the school athletic program.

Non musician/non athlete- any student who was never enrolled in the school music program or was never a member of the school athletic program.

Athlete – any student who was a member of the school athletic program and was not enrolled as a musician.

ITBS- Iowa Test of Basic Skills, a norm-referenced evaluation of skills administered in grades 1-8.

ITED- Iowa Test of Educational Development, a norm-referenced evaluation of educational skills administered in grades 9–11.

CAT- California Achievement Test, a norm-referenced evaluation of educational skills administered in grades 1–11.

School music program – organized class instruction in instrumental or vocal music.

School athletic program – organized sports programs administered by the school.

Quality Music Program – a band or choir program that has achieved a superior rating at a district concert festival during any of the years included in this study.

RELATED LITERATURE

It has often been said that music is a *universal language*, providing those who perform it unique understandings of asthetic and emotional happenings that surround them. Music serves to unite people culturally and helps others understand the nature of what makes individuals all different from one another and concurrently, the same. Every nationality and culture has a musical heritage that is part of the fabric of that society. Through music, people can share the abstract meanings of their society in a way that written and spoken language cannot. Thus, music is an important element in establishing a common thread by which people can communicate. Because music *touches* people, brings them together, and literally, *humanizes* them, its importance in the education of children has survived since the time of the ancient Greeks.

In the study of music, significant elements of a child's education find focus and expression. According to a report by the National Commission on Music Education (1991), what is true of all of the arts is supremely true of music. The study of music helps people (a) develop the ability to understand and use new symbols in context; (b) discover the power, precision, and control of mathematics in unexpected ways; (c) find and direct personal creativity; (d) exercise the diverse skills of problem solving; (e) experience the joy of self-expression; (f) grow into the liberation of self-discipline; and (g) participate in the deeply human satisfation of shared work and the gratification of challenges met.

A 1987 Music Educators National Conference report outlined 10 points that serve as a rationale for music education:

1. Music is worth knowing.
2. Music is one of the most important manifestations of a cultural heritage.
3. Music is a potential in every individual that should be devloped to its fullest.
4. Music provides an outlet for creativity, self-expression and individual uniqueness. It enables us to express our nobest thoughts and feelings.
5. Music teaches students about unique aspects of their relationships with other human beings and with the world around them, in their own and other cultures.
6. Studying music increases the satisfaction students derive from music by sharpening sensitivity, raising their level of appreciation, and expanding their musical horizons.
7. Music is one of the most powerful and profound symbol systems that exists.
8. Music opens avenues of success for students who may have problems in other areas of the curriculum and opens approaches to learning that can be applied in other contexts.
9. Music helps students learn a significant lesson. Not all aspects of life are quantifiable.
10. Music exalts the human spirit.

Certainly this rationale provides reasons for including music in school curriculum. One of these rationales points out that learning music aids students in opening approaches to learning that can be applied in other contexts. It is this rationale that is the impetus of the present study. Observers of children often witness the benefits of self esteem and self discipline associated with studying music, but are just beginning to examine how music education opens the approaches to learning in other contexts, as mentioned in the rationale.

Research provides evidence that a music curriculum aids students in developing the skills necessary for academic achievement. Studies into arts education, music curriculum, and reading and math curriculums give specific evidence of the positive connection between music education and academic achievement. Additionally, there is evidence that the longer one studies music, the more pronounced his or her academic gains will be.

There are a number of factors associated with the musical arts and how receiving a music education has a positive effect on other academic disciplines. Theories point to increased brain activity connecting musical activity and learning, personal self-discipline, the positive effects of group interaction with other musicians, and increased cognitive awareness. Gender bias is also an issue in many academic pursuits, and music education may be helping to lessen this effect. This study examines the role that music plays in the educational curriculum and how these roles interact with other academic endeavors.

Music and Mathematics

The connection between music and mathematics is evident in the very nature of the music discipline itself. Music is built on counting systems and is performed over time. Numerical subdivisions, overtone structure, and tuning systems (Pythagorean tuning) are examples of inherent relationships between math and music.

Evidence has been found that music instruction can lead to higher achievement in mathematics. Art Harrell, director of music for the Wichita, Kansas, public schools, conducted a project with 13,000 children in an ESEA Title I program of additional art, music, physical education, and industrial arts classes with enrichment and counseling. Although students began the program with roughly equivalent skills, Harrell found that students who had received school keyboard music lessons scored higher in mathematics

than students not in the program (ESEA, 1992). A study of the effect of participating in a beginning band program revealed that students in the beginning band program did significantly better on posttest math scores than students who were not enrolled in the program (Perry, 1993).

The California Arts Council's Alternatives in Education programs (AIE) has been in selected schools since 1986. The arts have been found to make a positive cognitive impact. When music periods have been increased, children have made an average gain of one and one-half times the normal rate in math (.75 years in 6 months) (Maltester, 1992). An ESAE Title I program to improve academic achievement found that students who had participated in keyboard lessons scored higher in math and history than students who had not participated, even though their IQ scores were not higher than those of the nonparticipating students (Broadhead, 1990).

Biophysicist Martin Gardiner and his colleagues postulated the theory that the arts, specifically music, can be useful in "stretching" other areas of learning. They found strong evidence that sequential, skill-building instruction in the arts and music, integrated with the rest of the curriculum, can improve children's performance in reading and mathematics. Their study included first graders who were divided into two groups, one based on regular arts instruction (one hour per week of music and visual art) and one *test arts* group who received two hours per week of music and visual arts instruction. After several months of instruction, the students were given the Metropolitan Achievement Tests (MAT) and the results were compared. Gardiner found that students in the *test arts* classes that had started behind the control students in percentage of students at or above the national average kindergarten MAT scores, had caught up to statistical equality in reading, and had pulled ahead in mathematics. Seventy –seven percent of those students

in the *test arts* classes were evaluated at grade level or above in mathematics, as compared with fifty-five percent in the control groups.

When the study was repeated the following year with second graders, the results were the same. Additionally, the theory that music instruction can increase learning over time was further bolstered. The percentage of students at or above grade level in second grade math was highest for those with two years in the " test arts" program, lower for those with one year, and lowest for those with no "test arts" program. One of the conclusions drawn was that the math learning advantage found in this study could reflect the development of mental skills such as "ordering", and other elements of thinking which mathematical learning at this age also depends (Gardiner, Fox, Knowes, Jeffery, 1996).

In a 1998 study on *cultural capital theory*, a concept which assumes that cultural knowledge can be used as a status symbol in schools for students to get better grades, Kadel found there was no statistical link based on this idea. He did discover, however, a connection between music and math. The study used data from the National Education Longitudinal Study and analyzed the effects of a range of cultural activities on achievement test scores and grades among high school students. Results indicated a curricular effect existed: music coursework and participation in school band had positive effects on math achievement. Research suggests that music instruction has an effect on verbal abilities as well as mathematical abilities and that student academic scores can be positively impacted by music education.

Music and Reading

Specific findings concerning the effect of music education on reading instruction point to increased student ability in the area of reading achievement. In a 1975 study of

the effects of music training on the reading performance of first graders, students were divided into two groups. One group received musical instruction 5 days per week. The other group received no special instruction. After one school year, the music group exhibited significantly higher reading scores than did the control group, scoring in the 88th percentile versus the 72nd percentile (Hurwitz, Wolff, Bortnick, Kokas, 1975).

An evaluation of the achievement in reading and math of elementary school students revealed that in reading for meaning, fifth-grade instrumental music students achieved at a higher level than their nonmusic student peers (Freidman, 1993). Another study revealed the impact that music instruction can have on other subjects such as reading.

Dryden (1992), in a study to determine the impact of music education on the academic achievement of fifth-graders, found that band participants had a statistically higher reading vocabulary and reading total achievement scores. She discovered that males who received music instruction scored statistically higher in reading vocabulary and that instrumental music students whose mothers had a post high school education also showed statistically higher achievement in total reading score. This study encompassed a sample of 270 fifth-grade students (135 boys and 135 girls) in a southwestern Kansas school district. The researcher used instrumental music status, gender, race, socioeconomic status, family structure, mother's level of formal education and time in the school district as independent variables. Specific scores from the Comprehensive Test of Basic Skills (CTBS) were used as independent variables. This research not only points out the connection of learning music to academic achievement but sheds light on other areas not found to be significant. Dryden found that socioeconomic status made no difference in improving reading scores but that the

mother's level of schooling did make a difference. Success in all education endeavors of children has always been a product of parental nurturing and expectation. More educated parents, regardless of their present socioeconomic status, expect academic success for their children. Length of time in the district was dispelled as a reason for academic improvement, possibly leading one to believe that even students who entered the school from elsewhere are equally affected by the consequences of musical instruction.

In yet another study, educators agreed that music education was beneficial to reading achievement. Music has been shown to be such an effective component of reading instruction that teachers are being urged to become competent instructors of music in the reading classrooms (Tucker, 1991).

A Title I reading program in Brooklyn, New York, included music and the arts in the curriculum. The results were dramatic rises in student reading achievement test scores (ESEA, 1990). Low achieving readers learned to read faster when music and related arts were included in the reading curriculum. In a study involving more than 13,000 children in 43 schools, the ESEA Title I Evaluation Report for Wichita Program for the Educationally Deprived Children found that gains were made in the corrective reading program when music and related arts were used in the curriculum (ESEA, 1992). The Project of Art as a Learning Strategy (PALS) was a well-planned curriculum that included music and a longitudinal study with carefully drawn conclusions. Students in this program out-achieved those not in the program when all were tested in reading proficiency (Project of Art as a Learning Strategy, 1993).

Evidence exists to support a positive relationship between music and language arts. In a study that compared the academic ability of instrumental musicians, athletic participants, and nonparticipants in either athletics or music, Trent (1996) found that the

musicians scored significantly higher on the verbal battery scores of the Texas Assessment of Academic Skills (TAAS) than those not involved in music.

In a 1986 study of the cognitive and behavioral consequences of using music and poetry in a fourth grade language arts classroom, Hudspeth designed a language arts curriculum combining traditional language arts tests and materials with choral reading, singing, moving, rhyming, and dramatizing. This program, entitled SAMPLE (Suggested Activities of Music and Poetry for Language Enrichment), also included poetry and prose. Students in the SAMPLE group used the same text as the control group but did not follow the text in sequence. Both groups of students were pre-and posttested on four subtests of the California Achievement Test: language mechanics, language expression, total language, and reference skills. The SAMPLE group scored significantly higher on the language mechanics and total language posttests. The same students also made significantly higher pretest to posttest gains on a measurement of writing test.

Further research has extended the positive effects of music education from reading and mathematics to many of the other curricular subjects. History and physical development have important relationships with music.

Music and Academics

Music education reached low ebb in the 1970s and 1980s during the *back to basics* movement. Music, as a curricular subject was regarded as a *frill*, unworthy of serious investment in educational time or money. Schools dropped their band, orchestra, and choral programs to save money and instructional time for more traditional academic subjects.

In an article examining the ways schools could improve, Gregorian (1997) mentioned that the arts should be a major part of all schools. He stated, "we've made a

tremendous mistake in diminishing or eliminating art, music and dance as fluff or frills. The arts allow children to develop creativity and imagination... it's almost impossible to overemphasize the creative arts in education (p. 14). The 1990s

> have seen this attitude changing, with many schools reviving or increasing their music programs. Parents have discovered that music, and the arts in general, are part of a well-rounded education. Musical talent affects all races and economic levels and there is increasing evidence that music in the schools has a *ripple effect* and actually improves many students' performance in other areas. (Kuppenberg, 1999, p.8)

Music as well as the other fine arts has been used as interdisciplinary tools to reinforce historical accounts and to *relive* those periods. The arts can enliven history so that students are drawn to how people of past times lived and thought. A comparison of the music, architecture, and design of the Renaissance and Baroque periods, Grout (1981) noted that music provided insight and clarity to the changes that distinguished the two historical periods.

A recent newspaper article demonstrated the shift towards the inclusion of more arts programs in schools

> research has shown that children need to learn in context to apply what they are learning in real life...these studies are showing that when the arts are in the classrooms, the students' performance in other subjects improves. This is for all age groups, for all kids, not just for the gifted and talented." (Pettus, 1999 p. 13)

Traditionally, music students have been considered high achievers whose academic abilities were enhanced by the discipline the arts has afforded them. High school music students have been shown to hold higher grade point averages (GPA) than nonmusicians do in the same school. In a 1982-1983 study at Mission Viejo High School in California, music students' grade point averages were 3.59 as an average for their group, while the nonmusicians averaged 2.91 as an average for their group. Furthermore, of the students who maintained a 4.0 average, the musicians accounted for 16% while the nonmusicians accounted for 5% (Horne, 1983).

Data released from the College Board 1997 Profile of College-Bound Seniors showed that students who participated in arts education courses in high school scored higher on the Scholastic Aptitude Test (SAT) (Educational Testing Service, 1997) than those who had not. The improvement continues to be more pronounced with increased years of participation. The mean SAT Verbal score for nonmusicians was 477 and the mean Math score was 492. For those students who were involved in music in high school, both the mean SAT Verbal and Math scores were 529. In a similar study done in 1998, it was found that students with 4 or more years of study in the arts outscored students with 6 months or less of arts instruction by a combined total of 82 points on the Verbal and Mathematics portions of the SAT (Educational Testing Service, 1998). In 1990 the National Center for Educational Statistics conducted a survey of 18,000 high school sophomores to gather information on the social and academic life of United States teenagers. While 22.8% of these students participated in school music programs, the percentage of music students was much greater than 22% of the entire group in receiving academic honors, making the honor roll, or being selected to class office. Additionally,

the center discovered that the grade point average (GPA) of music students was also higher. These results seem to confirm the findings of the College Board's SAT studies.

In a study by the Research Council for Science and the Humanities, a connection was found between students having musical competence and high motivation to achieve success in school. Students with interest and competence in school music were found to have a positive correlation with cognitive competence scores (Lillemyr, 1993). A research study done in the Chicago, Illinois, school system showed that achievement in school music builds student self-image, which is a motivation for academic learning among urban middle school students (Lamb & Gregory, 1993). An ESAE Title I program to improve academic achievement found that students who had participated in keyboard lessons scored higher in math and history than students who had not, although their IQ scores were not higher than those of the other students (Broadhead, 1990).

IQ scores and achievement test scores have often been used to measure student potential and competency. A study of an arts enriched language program found a positive effect on the attitude and IQ of second grade students (Gordon, 1989). Another study, of children in the Albuquerque, New Mexico, public school system, demonstrated that in all areas of comparison of scores on the California Achievement Test of Basic Skills, fifth-graders who were enrolled in instrumental music classes scored higher than their peers who were not enrolled. In 1990, students with 2 or more years of band instruction scored 10% higher than the others. In addition, those students who were enrolled in music programs for 2 or more years scored consistently higher than those who participated only one year (Glenn, 1992).

In a pamphlet issued by the Selmer Corporation, it was reported that admissions offices at 70% of the nation's major universities stated that high school credit and

achievement in the arts are significant credentials for admission. An increasing number of individual and state university systems are requiring high school credit in the arts for admission. Additionally, it was reported that 90% of students who participate in their high school bands, choirs, or orchestras go on to college and complete their undergraduate degree (Selmer Corporation, 1997).

The study of music helps produce the development of academic skills. A 1991 survey revealed that 40% of the Westinghouse Science Talent Search winners were accomplished musicians (California State Department of Education, 1991).

Research examining the academic abilities of students in 17 countries discovered that the top three countries were Hungary, the Netherlands, and Japan. All three of these countries included music throughout the curriculum, from kindergarten through high school. In the 1960s the Kodaly music education system was introduced into the Hungarian schools as a result of the outstanding academic abilities displayed by students enrolled in "singing" schools. At present, there are no third-graders who sing without proper tone and accurate pitch in Hungary. Additionally, the academic achievement of Hungarian students, especially in math and science continues to be outstanding. Both the Netherlands and Japan followed suit in the late 1960s and their students show remarkable academic abilities as well (Dickinson, 1993). The Hungarian embassy in Washington, D.C., issued a statement that said, "Hungarians have known for a long time that music education trains one to think and there is a very close connection between musical competence and mathematical ability" (Oddleifson, 1989, p. 13).

Music by its very nature requires complete coordination of touch, hearing, and sight. No other academic activity requires the simultaneous muscular response that performing music demands. Loyacono (1993) noted that

> not only is real thinking involved, but also the use of the part of the brain which controls muscular movement. Music facilitates the audio-tactile development of young ears and eyes, thereby strengthening the whole motor coordination into an experimental cognitive operation. (p.14)

Music is an art, a language, a discipline, and a method of instruction. These studies have explored the relationship between music and academic achievement with specific attention paid to what effect music instruction has on cognitive activities.

Because cognitive and higher order thinking skills are developed in music, Mickela (1990) discovered that music learning transfers to other subjects.The level of energy necessary and the ability to organize time and self-discipline are developed through the study of music. The rhythm of music transfers to the rhythm of reading. The learning and performance of rhythm develop eye-hand coordination necessary in other academic areas. In the same study, Mickela also found that auditory dicrimination developed by instrumental music training helped develop phonetic skills. In addition, memory training, listening, recall, and concentration were all skills developed in music study that transferred to academic areas. The evidence from the research strongly suggests there is a correlation between music instruction and higher test scores and grades.

Many of the best and brightest students demonstrate high levels of creativity. Creativity is a quality that needs nurturing and is an active outlet for students to develop to their full potential. Findings concerning the importance of music instruction as an aid to creative development connect the purely academic with the artistic world.

Creativity

Music as an academic discipline helps students identify and pursue their creativity. In doing so, music contributes to a student's self-image, thereby strengthening the bond between achievement in music and academics.

An investigation into the effects of various types of training on the creativity and learning abilities of 4 and 5 year olds showed that music training had a higher influence on test scores than other types of training. In this study, Mohanty and Hejmadi (1992) divided the students into four groups: (a) a nontraining group, (b) verbal instruction in the names and uses of body parts, (c) verbal instructions plus acting out movements, and (d) the music group, in which instructions were given by song. After one month, all of the experimental groups showed higher scores on the Torrence Test of Creative Thinking than did the control group. The music group, however, showed the largest improvement in both tests of creativity and learning about body parts. The results of this study indicate that many types of training activities boost cognitive development, but music is more effective than others.

Marshall (1978) reported that science, industry, and politics all place great value on creative potential and the need for the development of creative potential to be a high priority in education. Trent (1996) writes

> music develops all [academic] areas. The pride attached to most musical organizations allows the individuals to become confident about their abilities to achieve. This positive image leads to the investigation of the creative process. Music allows the child to create within a comfortable and safe environment. (p. 23)

The multidimensional thinking involved in grouping the harmonic and temporal concepts of music touches the most basic preconscious structures of the mind. The

discipline involved in the study of music demands the highest levels of intellect, memory, concentration, and emotion as well as the finest tuning of coordination and sensory awareness.

> The study of music is where we may learn commitment to quality and excellence in our own work and where we can explore the inseparable relationship of mind and body... it prepares us for the task of learning how to love. (Hollander, 1991, p.38)

Perhaps the most intriguing findings associated with music instruction and its effects on academic ability are found in studies on the functions of the human brain. As our understanding of how the brain works becomes more clear, the multilevel effects that music plays on all facets of life, including social, physical, and academic, will begin to present themselves.

Music and the Brain

Frank Wilson, Assistant Professor of Clinical Neurology at the University of California School of Medicine, San Francisco, reported that learning to play a musical instrument helped students to develop faster physically, mentally, emotionally, and socially. He stated that research shows that instrument practice to enhance coordination, concentration, memory, and improvement of eyesight and hearing acuity is possible. He concluded that learning to play an instrument progressively refines the development of the brain and the entire neuromuscular system (Sloboad, 1997).

Psychologist Francis Rauscher and neuroscientist Gordon Shaw have done two studies of increased cognitive ability and its relationship to music. In their first experiment, they found that listening to 10 minutes of Mozart's Piano Sonata K448 increased spatial IQ scores in college students relative to silence or relaxation

instructions. Spatial reasoning abilities are crucial for such higher brain functions as music and complex mathematics. This research demonstrated a causal link between music and spatial reasoning (Rauscher & Shaw, 1994). In the second study, Rauscher and Shaw found that the spatial reasoning performance of preschool children who received 8 months of music lessons far exceeded the spatial reasoning performance of a demographically comparable group of preschool children who did not receive music lessons. Scores on a puzzle task designed to measure spatial reasoning ability increased significantly during the course of the period the children received music lessons (Rauscher & Shaw, 1990). In another study examining the connection between intelligence and musical training, researchers found that piano instruction was superior to computer instruction in enhancing the abstract reasoning skills required for learning science and math. The study, done by Rauscher and Shaw (1997), included four groups of preschoolers: (a) one group that received private piano/ keyboard lessons; (b) a second group that received singing lessons; (c) a third group that received private computer lessons; and (d) a fourth group that received no training at all. The children who received piano/keyboard lessons performed 34% higher on spatial-temporal ability than the others. These findings indicated that music does enhance the higher brain function required for mathematics, sciences, and engineering.

The previously cited studies point to the effects of music as it manifests on the normal person. Music education and therapy have been linked to the positive cognitive and intellectual development of children with disabilities. Edgerton (1994) conducted a behavioral study to determine the effectiveness of improvisational music therapy on autistic children's behaviors. Using a test of measurement called the Checklist of Communicative Responses/ Acts Score Sheet (CRASS), Edgerton tested 11 autistic

children between the ages of 6 and 9 in a 10 week individualized improvisational music therapy sessions. He found a significant difference between the subjects' first CRASS session and their last sessions.

While there is evidence to support that music has a positive effect on academic achievement, many believe that much of the improvement demonstrated by music students is connected to their extracurricular involvement and is primarily attributable to some inherent disposition to outperform other students.

Extra-Curricular Activities

Research concerning the impact of student involvement in extracurricular activities (athletics, pep groups, and clubs) and the link to improved academics is inconclusive. In a 1992 study of the effects of interscholastic athletic participation on African American and Hispanic youth, Melnick found sports participation unrelated to grades earned or standardized test scores. He discovered that athletic participation enhanced popularity and contributed to greater involvement in other extracurricular activities. He did find, however, that depending on the school location, athletic participation was significantly related to lower dropout rates for some areas. In Trent's 1997 study of the effects of music instruction on academic ability, two of the independent variables tested included University Interscholastic League participants who were nonmusicians (athletes, cheerleaders, and club participants) and student who did not participate in anything at all. Trent revealed that the UIL participants in sports or clubs did not score significantly higher than the total nonparticipants whereas the musicians in this study scored significantly higher than both of the other groups.

Methodology

The subjects of this study were 346 performing music (band or choir), athletes, and students who were nonparticipants in either music or athletics enrolled in a large suburban/rural school district in the southeast United States. All data were collected from the core battery reading, language, and mathematics scores of the California Achievement Test from 1991 – 1995.

A multiple analysis of variance was employed to test for significant relationships between the dependent variables of reading, language, and mathematics and the independent variables of musician, athlete, and nommusician/nonathlete for each year of the study. Pairwise comparisons were accomplished using Tukey's HSD post hoc tests.

Results and Conclusions

The results of the statistical procedures revealed that all groups (musicians, athletes and nonmusicians/nonathletes were statistically equivalent in grades five and six (1991 – 1992). In the 7th, 8th, and 9th grades (1993 – 1995), the musicians achieved significantly higher mathematics and language scores than the athletes. Although the musicians did not significantly outperform the nonmusicians/nonathletes, by 9th grade, the musicians' standardized test scores tended to stabilize while the athletes and nonmusician/nonathletes showed downward trend (Appendix A).

Based on the researcher's knowledge of the music programs at the various schools included in study, the data indicated that another factor was perhaps playing a role in outcome of this study. This other factor was *quality* of the music program. When quality, in this case, a groups' participation at a district concert festival, was included as a factor, those music students involved in programs that were considered *quality* achieved

significantly higher scores than the athlete and nonmusician/nonathletic groups (Appendix B).

Discussion

This study sought to determine if participation as a musician or athlete had an effect on academic achievement as measured by standardized test scores. Results showed that although the mean scores for the musicians were higher than non-musicians/non-athletes, participation in music was not a conclusive factor in predicting statistically higher academic scores than non-musicians/non-athletes. The results did show that musicians scored statistically higher than the athletes did and that over time, the gap widened. Subsequent research revealed that the quality of the music program contributed significantly to higher scores on the CAT than the other groups.

The College Board 1997 Profile of College Bound Seniors showed that students who participated in arts education courses in high school scored higher on the SAT than those who had not. Although this study cannot draw firm conclusions concerning the effect that music participation has on academic achievement, the upward trend of the mean musician scores does support this literature, showing that music participation may have a significant effect on achievement.

This study also supports the findings of Melnick (1992) and Trent (1997). Those studies showed that participation in athletics did not positively affect test scores. In this study, the musicians' scores on all tests from 1993-1995 were significantly higher than the athletes' mean scores, indicating that participation in music may be more advantageous academically than participation in athletics.

The results of this study indicated that factors other than enrollment in a performing music class were affecting the outcome. The schools in this study represented

not only a cross section of urban, suburban and rural students, but also a cross section of different types of music programs, all with different priorities. Schools in which the music program concentrated on concert literature as the focus of the program had higher mean scores than those without a concert focus. Since it is generally accepted that quality music programs perform high quality musical literature, the inference may be made that the quality, involvement and vibrancy of the music program itself influences the effects of music class enrollment on academic achievement. Programs producing better musical results may possibly affect how students learn. Thus, by association, students are stimulated academically.

The results of this study indicated an overall drop in standardized test scores in the ninth-grade. The musicians did not show this drop in scores. Although many factors could influence a drop in scores, it is possible that the drop was associated with the effects of student transition to the high school environment. The musicians in this study actually increased their language scores slightly. Therefore, it is possible that the effects of transition to high school are somewhat offset by membership in the band or choir.

Implications

The present study was concerned with determining the relationship between participation in music, athletics or non-participation in either and the effect of this participation on standardized test scores. An important goal in the study was to provide data which would be useful to school systems.

A body of research literature existed before the present study that suggested the potential for a relationship between musical participation and increased academic achievement. It was proposed in the present study that the musicians would achieve

significantly higher scores on standardized tests than their athletic and non-musician/non-athletic peers.

This study has shown that musicians who participated in *quality* music programs achieved higher mean scores on standardized tests than their nonmusician/nonathletic peers over time and significantly higher standardized test scores than their athletic peers. Indications are, that based on existing research for high school seniors, the separation of standardized test scores of these groups may continue.

Implications for school systems include the establishment, retention and broadening of new and existing music programs. School districts should concentrate on efforts to build high quality, concert literature based music programs that require focused study and higher-order thinking skills.

Appendix A

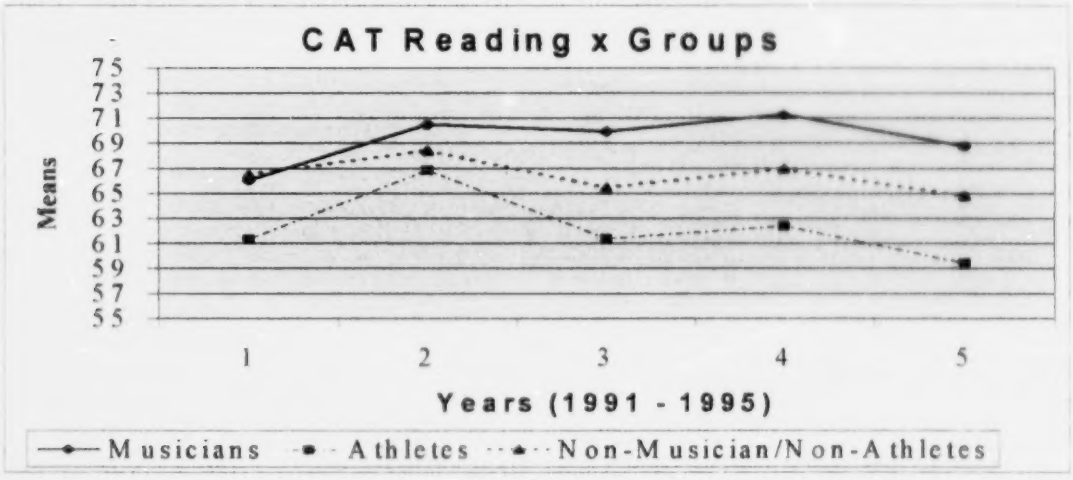
Table 1

Descriptive Statistics for the CAT Core Battery Reading Test – 1991 - 1995

Group	Means				
	Reading (1991)	Reading (1992)	Reading (1993)	Reading (1994)	Reading (1995)
1.Musicians	66.06 (22.85)	70.50 (20.86)	69.92 (22.82)	71.27 (21.03)	68.80 (22.65)
2.Athletes	61.35 (24.27)	66.84 (22.16)	61.38 (23.48)	62.41 (25.62)	59.44 (25.53)
3.Non Mus/ Non Athl	66.49 (23.25)	68.43 (20.85)	65.46 (22.75)	66.97 (23.71)	64.80 (24.32)

Note. Values enclosed in parentheses represent standard deviation.

Figure 1 California Achievement Test – Reading by Groups Expressed by Means for the Years 1991-1995.



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Descriptive and graphical statistics are presented for the 1991 – 1995 CAT Language core battery scores in Table 2 and Figure 2.

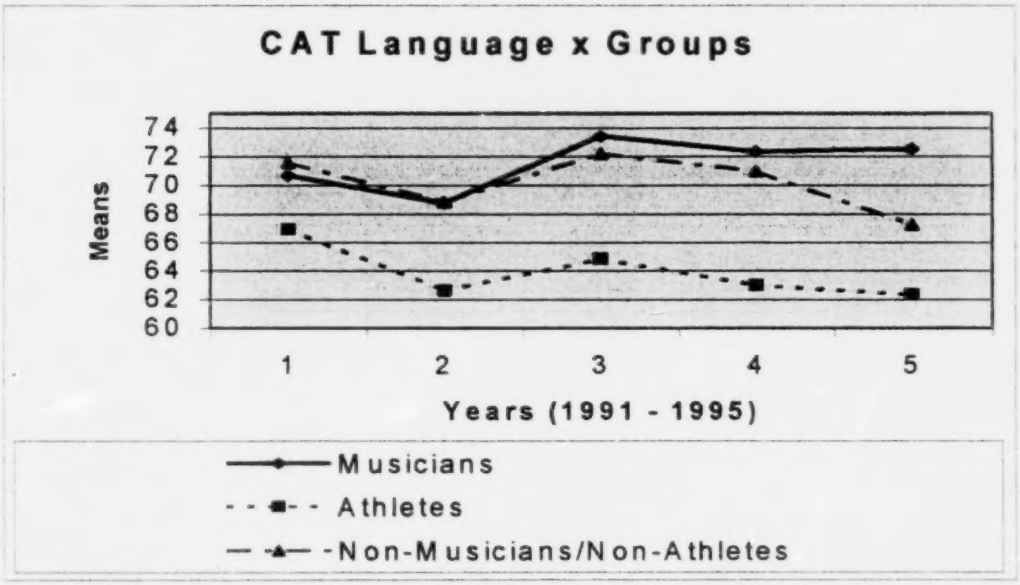
Table 2

Descriptive Statistics for the CAT Core Battery Language Test – 1991 - 1995

Group	Means				
	Lang (1991)	Lang (1992)	Lang (1993)	Lang (1994)	Lang (1995)
1.Musicians	70.69 (24.17)	68.76 (23.02)	73.44 (21.82)	72.34 (23.55)	72.55 (20.98)
2.Athletes	66.94 (24.98)	62.64 (24.38)	64.84 (23.72)	62.99 (26.19)	62.34 (25.38)
3.Non Mus/ Non Athl	71.57 (22.09)	68.83 (22.26)	72.20 (22.20)	70.97 (22.71)	67.24 (23.71)

Note. Values enclosed in parentheses represent standard deviation.

Figure 2 California Achievement Test – Language by Groups Expressed by Means for the Years 1991-1995.



Descriptive and graphical statistics are presented for the1991 – 1995 CAT Mathematics core battery scores in Table 3 and Figure 3.

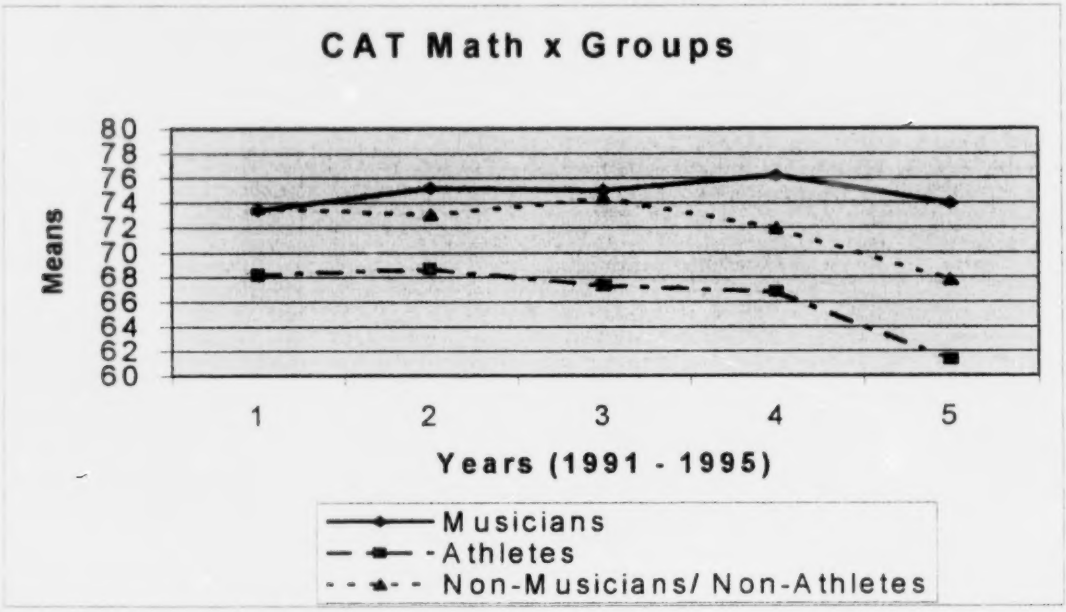
Table 3

Descriptive Statistics for the CAT Core Battery Mathematics Test – 1991 - 1995

Group	Means				
	Math (1991)	Math (1992)	Math (1993)	Math (1994)	Math (1995)
1.Musicians	73.40 (21.95)	75.21 (20.88)	74.99 (21.09)	76.22 (22.51)	73.96 (20.80)
2.Athletes	68.20 (24.78)	68.61 (23.65)	67.28 (23.77)	66.78 (27.00)	61.28 (26.70)
3.Non Mus/ Non Athl	73.57 (21.86)	73.07 (22.98)	74.39 (22.50)	71.91 (24.93)	67.78 (24.83)

Note. Values enclosed in parentheses represent standard deviation.

Figure 3 California Achievement Test – Mathematics by Groups Expressed by Means for the Years 1991-1995.



Examination of the data suggests that although there is no statistical difference between the musicians and nonmusicians/nonathletes groups by years, the line graphs indicate the possibility that these groups may become more different over time. Subsequent findings related to quality of the music program substantiate these differences.

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Table 4

Multivariate Analysis of Variance

Omnibus Linear Differences Between Groups By Year

Year	F
1991	.863
1992	1.45
1993	2.43*
1994	2.41*
1995	3.21*

Note. df (6, 728) for all years. * - $p < .05$
Post Hoc tests for statistically significant F values presented in later tables.

TABLE 5

Tukey's HSD Univariate Comparison of Pairwise Differences – 1993 (7th Grade)

Source	Mean Difference		
	Reading	Language	Mathematics
Music x Athlete	8.24*(2.94)	8.60*(2.88)	7.72(2.84)
Music x NM/NA	4.15 (2.94)	1.23 (2.88)	.602 (2.84)
Athlete x NM/NA	4.08 (2.94)	7.37*(2.88)	7.11*(2.84)

Note. * - The mean difference is significant at the .05 level.
Values enclosed in parentheses represent standard error.

TABLE 6

Tukey's HSD Univariate Comparison of Pairwise Differences – 1994 (8th Grade)

Source	Mean Difference		
	Reading	Language	Mathematics
Music x Athlete	8.85*(3.00)	9.35*(3.09)	9.44*(3.15)
Music x NM/NA	4.30 (3.00)	1.38 (3.09)	3.50 (3.15)
Athlete x NM/NA	4.55 (3.0)	7.98*(3.09)	5.94*(3.15)

Note. * - The mean difference is significant at the .05 level.
Values enclosed in parentheses represent standard error.

TABLE 7

Tukey's HSD Univariate Comparison of Pairwise Differences – 1995 (9th Grade)

Source	Mean Difference		
	Reading	Language	Mathematics
Music x Athlete	9.36*(3.07)	10.17*(2.99)	12.68*(3.10)
Music x NM/NA	2.64 (3.07)	5.64 (2.99)	5.86 (3.10)
Athlete x NM/NA	6.71 (3.07)	4.53 (2.99)	6.81*(3.10)

Note. * - The mean difference is significant at the .05 level. Values enclosed in parentheses represent standard error.

Appendix B

TABLE 1

Tukey's HSD Univariate Comparison of Pairwise Differences of *Quality* Groups – 1994 (8th Grade)

Source	Mean Difference		
	Reading	Language	Mathematics
Music x Athlete	9.856*(3.05)	9.96*(3.10)	10.34*(3.13)
Music x NM/NA	5.67* (3.05)	3.45 (3.10)	5.10* (3.13)
Athlete x NM/NA	5.78* (3.05)	8.45*(3.10)	6.24*(3.13)

Note. * - The mean difference is significant at the .05 level.
Values enclosed in parentheses represent standard error.

TABLE 2

Tukey's HSD Univariate Comparison of Pairwise Differences of *Quality* Groups – 1995 (9th Grade)

Source	Mean Difference		
	Reading	Language	Mathematics
Music x Athlete	11.21*(3.08)	12.34*(2.97)	14.54*(3.08)
Music x NM/NA	3.88 (3.08)	6.65* (2.97)	6.98* (3.08)
Athlete x NM/NA	7.68* (3.08)	5.89* (2.97)	7.51*(3.08)

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